doi: 10.2166/9781789063370_0081

# Gustaf Olsson – teacher, supervisor, inspirer, friend

*Stefan Diehl[1], Ulf Jeppsson[2] and Christian Rosén[3]*

*[1]Centre for Mathematical Sciences, Lund University, PO Box 118, SE-22100 Lund, Sweden (stefan.diehl@math.lth.se)*
*[2]Division of Industrial Electrical Engineering and Automation (IEA), Department of Biomedical Engineering, Lund University, PO Box 118, SE-22100 Lund, Sweden (ulf.jeppsson@iea.lth.se)*
*[3]AnoxKaldnes, Veolia Water Technologies, Klosterängsvägen 11A, SE-22647 Lund, Sweden (christian.rosen@veolia.com)*

## 11.1 OUTLINE

The three authors of this short Festschrift have had the privilege of working together with Gustaf Olsson for several decades in numerous roles: as undergraduate students, as Ph.D. students, as postdocs and as senior researchers. Most importantly, we are all very close friends to Gustaf. Below, each of us provide a few personal reflections related to how Gustaf has been a beacon of light for us and has had great influence on both our professional and personal lives.

## 11.2 SOME OF STEFAN'S ENCOUNTERS WITH GUSTAF

When you think about Gustaf, you smile. He seems always so happy, enthusiastic and positive, but also in a hurry. One gets the impression it is because there are so many things in life and research still to be discovered. He is genuinely interested in the people he meets. Even if he has met someone only once before, he remembers details about that person and asks relevant questions about that person's interests.

My first impression of Gustaf was in the undergraduate course on automatic control when he held the weekly seminar classes. Right on time, he rushed into the class room and seemed to find out during the first couple of seconds what the topic was that day. He then caught our total attention when explaining how to think about abstract concepts and what is really going on in the problem at hand in addition to solving it on the blackboard. We learned a lot during these seminars, and above all, that automatic control is fun. He was an authority in a positive way and gave us plenty of questions during his lectures so that one had to stay alert.

A wastewater treatment plant contains several different subprocesses that need different types of models to describe. Gustaf's interest and knowledge about all of them is known through all his books, publications, courses and talks. In the mid-1980s, the ASM1 model was published and gave a valuable and satisfactory description of the biochemical reactions in a biological reactor. It was possible to simulate all concentrations as functions of time, since the model was a system of ordinary differential equations. One complicated process in the treatment plan that occurs in the secondary clarifier, or sedimentation tank, where the activated sludge (living bacteria) coming from the biological reactors is separated from the purified water and recycled to the reactors. The process of sedimentation by gravity had been used since the beginning of the 20th century; however, it was known to be difficult to predict and control. In the mid-1980s, there was no mathematical satisfactory model for the process. The few simulations that had been made easily showed instabilities, in particular near the so-called sludge blanket – a visible large concentration discontinuity in the tank. Since the concentrations in the tank depend on both time and space, a mathematical model necessarily consists of a partial differential equation (PDE). Such nonlinear equations are difficult to solve, and it is difficult to create reliable simulation methods that give approximate solutions.

Gustaf approached his colleague Dr Gunnar Sparr at the Department of Mathematics, who thought the problem was interesting. I was at the time a curious student attracted to the problem, which therefore became my master's thesis project. Once the PDE model of the sedimentation process was established, we found that there was neither any textbook nor any publication that had treated a similar mathematical problem. The sedimentation of particles in a liquid is a nonlinear process that gives rise to shock waves (look at a glass of squeezed orange juice and you will after a while see a layer of high concentration at the bottom rising upwards while the juice particles settle downwards). In addition to this, an essential difficulty is the feed inlet and the upward and downward flows, which means that the PDE has coefficients that are discontinuous functions of the depth in the tank. It turned out that fundamental research in mathematics had to be done. This rich problem gave rise to both an MSc thesis and a PhD thesis for me, and I still today produce results on the application to wastewater treatment with the ironic comment from my math colleagues: 'So, you are still stuck in the sludge'.

I am so happy that Gustaf brought this problem to the mathematicians' attention and I am grateful for the support he has given me during all these years. It has been an excellent problem in applied mathematics, rich of challenges in both modelling, mathematical and numerical analysis, control aspects, and creation of reliable simulation methods.

When I was a fresh doctoral student, Gustaf took me to the impressive IAWPRC (today IWA) conference in Yokohama and Tokyo in Japan in 1990. I am very grateful for the way he treated me when introducing me to the 'big guys' in the field and pushed for our new results in my first publication (Diehl *et al.*, 1990). Gustaf was able to handle all situations, even the awkward one when the big opening ceremony was about to start and one of the Japanese organizers of the conference bumped into Gustaf with his wife Kirsti, Gilles Patry with his

wife and me, dressed in shorts and T-shirts on our way to do sightseeing. All of us more or less hid behind Gustaf and let him do the talking, explanation and giving the excuses. We thought this was the best opportunity we had for sightseeing, but quickly learned how important official ceremonies are in Japan.

Gustaf has many abilities of different kinds to look up to and I will mention only two more. If you have not yet heard Gustaf play the piano, I advice you to do so! Often when Gustaf arrives to a new city somewhere in the world one of his first tasks is to check if there is some organ in a church (or other official building) close by that he may be allowed to try out. Another 'other fact', which I think is part of his success and large network, is that Gustaf is a great connector. He connects people in a friendly and positive way. This is particularly valuable at conference, where many people meet and greet most everybody knows Gustaf and he also seems to know so many people at any conference. In a group of people chatting, he introduces people to each other with some cleverly concluding sentence of a key achievement of each person, so that a new connection between two previously unknown people occurs.

Gustaf has always been busy with a full schedule. After his official retirement, I met him in the queue at the local lunch restaurant at the Faculty of Engineering in Lund and asked how he felt and what he did now. He replied: 'It's wonderful, I can do what I want and I have now reduced my workload considerably down to 100%!' Still today, he works more than most and spreads wisdom, happiness and hope around the world and we are happy with whatever percentage (Figure 11.1).

**Figure 11.1** Gustaf relaxing with some friends at the Lund University International Guest House in 2004 (from left: Quim Comas, Erik Lindblom, Christian Rosén, Krist Gernaey, Ulf Jeppsson, Gustaf Olsson).

## 11.3 A LIFE-CHANGING MEETING FOR ULF

'What is wrong now?', I thought to myself after visiting the IEA bulletin board in the early summer of 1988 to find out the results of my very last exam at LTH before concluding my MSc education. The result itself was good enough (actually above the maximum grade, which is hardly possible nowadays) but there was also a special marking after my name. Checking the end of the page the marking was explained as: 'Please contact professor Gustaf Olsson'. I was just about to finish my MSc thesis project and then I was off to some industry to start working in the real world. At least that was my plan. But as Gustaf was the examiner and head teacher (and of course did a remarkable job) on this final course I could not just ignore the request. A few days later I stepped into his office, somewhat worried about what this meeting would be about. He greeted me with the words: 'Have you ever considered enrolling as a PhD student?'. My own knowledge on that issue was fairly limited and the idea had never really crossed my mind. But after a two-hour meeting with Gustaf where he spoke with great enthusiasm about wastewater treatment (a topic I new absolutely nothing about) in combination with automatic control, on-line state estimation, artificial intelligence (AI), knowledge-based systems and so on, I was ready to sign just about any paper he would have put in front of me. I had been recruited by Gustaf and started my PhD studies a few months later with Gustaf as my main supervisor. Thirty-four years later I am still at Lund University working with water and wastewater within that very same department. And no regrets whatsoever!

Seven years later I defended my PhD on modelling of wastewater systems. Note, the topic of my thesis changed somewhat because the world (including computer hardware and sensor data quality) was not ready to do the things Gustaf had intended during this early first hype of AI. But the ambition to do research in the forefront of what is possible is one of Gustaf's excellent characteristics. In the world according to Gustaf nothing is impossible, but some things simply take a bit longer time. When this text is written (2022), I have two PhD students of my own working in the field of AI, machine learning and digital twins for wastewater systems. So you were right Gustaf! We are gradually getting there but it took somewhat longer time than initially expected.

During my years as a PhD student Gustaf was the best supervisor one can imagine. Always kind, positive and encouraging, with great knowledge in the field and a huge network of international researchers which he so willingly introduced me to. He also taught me to always do the best I possibly can, take initiatives, the importance of loyalty and ethics towards science and colleagues and the necessity of hard work and never to give up on a topic. Very limited research is the result of 'divine inspiration' but rather of 'massive transpiration'.

Obviously there have also been some drawbacks of working close to Gustaf for so many years. 'This is the final call for passenger Gustaf Olsson. Proceed immediately to gate number X' is something I have heard several times when nervously waiting for Gustaf at some gate to fly off to some conference around the globe. When it was later time to go to bed in a joint hotel room it was always a good idea to bring a set of ear plugs as his snoring could (can) be quite offensive.

And when it was time for breakfast he had (has) a strange tendency to prefer a McBreakfast at some local burger joint rather than a prepaid extravagant hotel buffe breakfast. I have never been able to figure out the reason for this odd craving.

It is surely amazing how Gustaf has been able to accomplish all he has done – developing new courses, teaching (teacher of the year already in 1993 at Lund University and still active teacher), head of department, 100++ MSc and 45+ PhD supervision tasks, writing an almost infinite number of applications for research funding, project manager for a huge number of research projects, extensive publication including 12 books (IWA Publication award 2010), leading functions at Lund University and on national level boards and committees, highly active within IWA (former chair of the ICA specialist group, former member of the Strategic Council and Board, Honorary member (2012) and Distinguished Fellow (2014)) and many other international organizations, editor-in-chief for *Water Science & Technology* and *WST: Water Supply* and the on-line journal *Water Practice and Technology* (2005–2010), arranging national and international conferences, guest professor and advisor at several universities across the globe, and so on, and so forth. And all of this has been done with the same enthusiasm and willingness to do good. It is indeed a most remarkable career. However, Gustaf also has the great ability to bring out the very best of his co-workers and hopefully that can partly explain how the above is at all possible.

I personally have Gustaf to thank for so much, both professionally and otherwise. But I am most proud and happy to have Gustaf as my close friend.

## 11.4 A FEW THINGS CHRISTIAN WANTS TO THANK GUSTAF FOR

'Not again!', I remember sitting at my desk at the department of Industrial Electrical Engineering and Automation, Lund University wondering what just happened and how it could be that I yet again did not get the answers I needed in the relatively rare student/supervisor meeting I just had. Although frustrated, I also remember feeling happy and full of enthusiasm in contrast to how miserable I felt before the meeting. All the frustration with my lack of progress was gone and the confidence in my abilities was back. But no perfect answers…

This is what it was like to have a Gustaf as my PhD supervisor. He rarely gave me direct answers to my problems but always gave me the tools and the confidence to find the solution on my own. After a meeting with Gustaf, no challenge was too big or impossible and although no solution was yet found, the feeling was that finding it was just a matter of time. Sometimes a lot of time afterwards and sometimes in unexpected places but when the answer was eventually found, the solution *was my own*. This was a feeling that was extremely rewarding and confidence building for a PhD student. Gustaf's ability to be patient and trust me to find my way forward is probably one of the most important factors for my development as a young engineer and researcher and something I still benefit from when I approach new and sometimes seemingly insurmountable challenges.

I mentioned that my student/supervisor meetings with Gustaf were quite rare. This does not mean that Gustaf was not available. His door was always open and I cannot even remember that he ever said that he did not have time for a chat about work or just about anything. And in these informal and spontaneous talks Gustaf did answer a lot of questions, from questions about being a young PhD student and wondering about the future to more broad and even existential questions about being a human being and how to see the world we are living in.

In the competitive world of research, Gustaf always advocated collaboration before competition. From the early years of my PhD work, he encouraged me to collaborate with other researchers and engineers. In the beginning, this was limited to local or national contacts but it was soon expanded to international collaborations. Gustaf seemed to know everyone (both in his own field but also in other fields) and he introduced me to his contacts from all over the world, from Australia to North America. The very open and inclusive way Gustaf headed the department meant that we had a lot of visiting researchers bringing ideas and experiences from all corners of the world. This exposed me to an academic and industrial world more international than national and expanded the horizon for me on a personal level. This 'internationalism' became a natural state for me in a way I only realized when I, after leaving academia, no longer


**Figure 11.2** Gustaf being honored by Professor Zhiguo Yuan in 2009 for his life-long achievements in bringing ICA to the wastewater community (ICA2009, Cairns, Australia).

had it. Fortunately, I soon learned that similar ways of working and exchanging experiences do exist in industry as well.

My years at Lund University as a PhD student and young researcher to a large extent shaped me into what I am today. The opportunities I had and still have in my professional life are a direct consequence from working for and with Gustaf and my other colleagues during these years.

For this and so much more I am forever grateful to Gustaf (Figure 11.2).

## 11.5 SUMMARY

Numerous prizes and awards are tangible evidence for Gustaf's achievements but the many students and fellow water professionals being inspired and picking up ideas and research are an even more important legacy. We know that many more colleagues have similar experiences as we (the authors) to share about Gustaf as a mentor, inspirer and friend. However, we have had the privilege to experience the great knowledge and even greater enthusiasm and positivism that is the signum of Gustaf on an almost daily basis for 2–3 decades. We are forever in your debt, Gustaf! Thank You so much for all You have done and given us over the years!

## REFERENCE

Diehl S., Sparr G. and Olsson G. (1990). Analytical and numerical description of the settling process in the activated sludge operation. In: Instrumentation, Control and Automation of Water and Wastewater Treatment and Transport Systems, R. Briggs (ed.), IAWPRC, Pergamon Press, Oxford, UK, pp. 471–478.